

**FUNDAMENTALS
OF
GAS APPLIANCES
THIRD EDITION**

Fundamentals of Gas Appliances
Combined Manual and Workbook

ORIGINALLY PREPARED BY
Gas Appliance Manufacturers Association

For

AMERICAN GAS ASSOCIATION
400 North Capitol Street NW
Washington, DC 20001

Catalog No. XH0501

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By
American Gas Association
First Printing August 2005

Printed in United States of America

Catalog No. XH0501
Third Edition, First Printing
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Printed in the United States of America

Cover photos furnished by North American Technician Excellence (NATE), Vent-Free Gas Products Alliance and Gas Appliance Manufacturers Association (GAMA).

FOREWORD

The original manual was prepared under the direction of the American Gas Association and Gas Appliance Manufacturers Association, Inc. Joint Committee for Customer Service, and written by J. Fred Parr, Manager of Engineering Services, American Gas Association Laboratories, Cleveland, Ohio. The 2005 edition was edited and prepared by Mary Smith Carson, Consultant, Roger Carson Enterprises, Inc. (RCEI). The editors wish to thank James W. Freeman, Vent-Free Gas Products Alliance, Rheem Water Heaters, Whirlpool Corporation, Monessen Hearth Systems, ECS, Rasmussen Iron Works, Cozy Heating, Copreci S. Coop., David Sutula and David Bixby of GAMA for their assistance.

The purpose of the manual is to provide a text for self-study. It is intended to become a useful tool to vocational-technical schools, appliance service and repairpersons, and utility customer service programs. The text has been prepared so that only a moderate knowledge of mathematics and science is required for understanding.

Other texts in this series cover the following fundamental subject areas:

- Venting and Ventilation
- Electricity
- Gas Controls
- Gas Combustion
- Customer Service

A glossary is provided at the rear of the book. The text material will be more meaningful to the students if they familiarize themselves with these terms. Words that are defined in the glossary are noted in bold face type the first time they appear in the text.

For specific installation instructions always refer to the manufacturer's instructions and or the local codes required by the authority having jurisdiction.

This book is meant to be used only as a guide in explaining the fundamentals of the specific gas appliances listed within it. For more detailed information concerning a specific make or model of a gas appliance always check with the manufacturer. Most manufacturers offer installation and service manuals on their specific internet website.

RCEI wishes to thank all the members of the American Gas Association Utility and Customer Field Services Committee for their review and editorial comments.

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This manual is not designed to provide installation, repair or maintenance instructions. Equipment should be installed, repaired or maintained in compliance with manufacturers' instructions, applicable building codes and regulations and national standards. This manual is not intended to take the place of those documents.

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Third Edition

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I

INTRODUCTION

Because gas is such a safe, clean-burning, easily transported fuel, the gas industry and gas appliance industry have grown together to become one of the major sectors of our nation's economy. Currently, gas is used in about 60 million American homes for heating, cooking, clothes drying, water heating, grilling, lighting, cooling, and in fireplaces and stoves.

The first appliances were gas lights used over 150 years ago for street lighting. Shortly after, gas was used for cooking but few gas appliances were manufactured until the turn of the century because extensive distribution of natural gas had not begun. By 1925, the number of appliances manufactured had increased to the point where an appliance safety approval program was needed and the American Gas Association Testing Laboratory was opened to serve this need. Later renamed AGA Laboratories until 1997 when it ceased operations. Today, a similar test program is conducted by CSA International. They have facilities in the U.S. and Canada and test gas appliances, component parts and accessory designs. According to GAMA, an association of appliance and equipment manufacturers, in, 2002 more than 9.5 million gas water heaters, furnaces, boilers, and hearth appliances were shipped from manufacturers in the United States. Sixty million U. S. households are heated with natural gas.

USING THE HEAT

With the exception of gas fuel cells, all gas appliances are designed on the basis of using the heat generated by combustion to perform some

task. Most appliances are made for heating air or water directly for space heating or water heating.

Others are for heating and cooking food. Gas air conditioners utilize the heat produced in an indirect fashion. With these appliances, the energy to do work comes from the heat produced by combustion of the gas. Any consideration of the control and functioning of any appliance must be based on the utilization of this heat.

USE OF GAS

In addition to the 60 million domestic customers mentioned earlier, about five million commercial establishments use gas. These include bakeries, restaurants, hospitals, schools, auto washes, laundries, and public swimming pools. These gas users employ gas appliances that are, in many cases, similar to domestic ones except they are larger and sometimes have more complex controls; for example, baking ovens and commercial water heaters and dishwashers.

About 40 percent of the gas produced in the United States is used in industry. Large quantities of gas are used in making steels, glass, chemicals, paper and in food processing. The gas combustion equipment used in these industrial processes differs substantially from that used in domestic applications, but the idea is the same—utilization of the heat energy produced.